

## TREEHOPPERS (HOMOPTERA:MEMBRACIDAE) COLLECTED AT MULTIPLE LEVELS IN A DECIDUOUS WOODLOT IN DELAWARE<sup>1,2</sup>

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**ABSTRACT:** Fifty-five species of Membracidae were collected by handpicking, sweeping and sticky-cylinder trapping. The latter occurred at levels ranging from 1-27 m above ground level and produced 82% of the species collected. Most species (53) were taken at levels of 3 m or less by the combination of methods. Some species were collected most abundantly at levels of 6-27 m.

Other than Bray and Triplehorn (1953), little attention has been given to the treehopper fauna of Delaware until recently. Bray and Triplehorn (1953) found 9 species of treehoppers in their survey of red and pin oak. Mason and Loye (1981) listed 61 species in the state and reported on a number of plant associations.

This study was initiated to survey the membracid species in a deciduous woodlot located at the University of Delaware. It was decided that some trapping should be done at a range of levels extending from the ground to the forest canopy. This was to ensure that tree dwelling species would be represented in the survey.

We are not aware of any publications on the systematic collection of treehoppers at various heights in wooded habitats. Kopp and Yonke (1970) reported on treehopper species collected by various methods, including sticky-boards placed in trees at unspecified heights as well as near ground level, but no separation was made between species taken near ground level and in trees.

### METHODS AND MATERIALS

The study was conducted from May to October, 1978, and May to August, 1979, at the Department of Entomology and Applied Ecology woodlot located on the University of Delaware Agricultural Research

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Farm in Newark, DE. The woodlot is a 40 acre densely wooded area with *Liriodendron tulipifera*, *Acer rubrum*, *Liquidambar styraciflua*, and *Quercus* sp. as the predominant species.

Sticky-cylinder traps were maintained at several locations representing as many different plant associations as practical. The traps were placed at various heights and kept at these levels throughout the study, except when being serviced. The number of traps at each height was as follows: 9 traps at 1 m; 5 traps at each level of 3 m, 6 m, and 9 m; and 2 traps at each level of 12 m, 15 m, 18 m, 21 m, 24 m, and 27 m. The traps at 21 m, 24 m, and 27 m were added in 1979.

Cylindrical sticky traps were selected since Adlerz (1976) found no difference between this type and vertical sticky boards for numbers of aphid species captured. Each cylinder consisted of a 30 cm length of 10 cm diameter Crestline<sup>®</sup> plastic drain pipe. The outer surface of each drain pipe was painted with Krylon<sup>®</sup> fluorescent yellow spray paint. A piece of transparent Teflar<sup>®</sup> plastic, cut to fit the outer surface of the cylinder, was attached to the cylinder with paper clips and then coated with Tanglefoot<sup>®</sup> adhesive. Sticky-cylinder traps were secured to wooden stakes at the 1 m level. At levels from 3-27 m, the traps were attached to ropes which were suspended from pulleys affixed to tree branches. The ropes were maintained from the pulleys so that the traps could be raised to the desired height for the trapping period and lowered for servicing. The end of the portion of rope attached to the trap was tied so that the trap was maintained in a vertical position. The free portion of the rope was tied at an angle to keep it from contacting the sticky surface of the trap.

The sticky-cylinder traps were serviced by removing treehoppers and recoating with adhesive. Adhesive was removed from specimens by washing them in xylene. Servicing was conducted each week during 1978. Because specimens and adhesive were retained in excellent condition for a longer period, servicing was performed at two week intervals in 1979.

Additional collections were made from low level vegetation by sweeping with a standard 30 cm insect net and by handpicking specimens directly from the plant.

Membracid specimens were preserved in alcohol or pinned, identified and placed in the Entomological Collection at the University of Delaware.

## RESULTS AND DISCUSSION

A total of 55 membracid species was collected in this study. The species are listed in Table 1 along with the total number of adults taken at each level of sticky-cylinder traps and those captured by handpicking and sweeping from vegetation near ground level. The number of species taken in our study is analogous with that of Dennis and Dicke (1953) where 50 species were collected in a 150-200 acre arboretum in Wisconsin.

Of the total species collected, 82% were taken by sticky-cylinder traps. Of this category, 64% of the species were trapped within the levels of 6-27 m. Also, 82% of the trapped species were taken at the single level of 1 m.

More species (85%) were collected by handpicking and sweeping than all sticky traps combined. Similarly, Kopp and Yonke (1970) found sweeping and handpicking to be the most productive collecting method.

Only two species, *Glossonotus crataegi* (Fitch) and *Telamona westcottii* Goding, involving three specimens, were taken solely within the levels of 6-27 m. Given sufficient numbers of each species, it may be concluded that nearly all treehopper species can be collected in the 0-3 m space of a wooded area.

When considering the species collected most abundantly on sticky-cylinder traps (Table 2), three distinct patterns of height can be seen. *Entylia carinata* (Forster), *Acutalis tartarea* (Say) and *Micrutalis calva* (Say) were most abundant at the 1 m level. *Telamona decorata* Ball and *T. monticola* (F.) were most frequently taken from traps at high levels of 6-27 m. *Cyrtolobus tuberosus* (Fairmaire) and *C. dixianus* Woodruff were spread across levels of 1-15 m.

This study has shown that, when surveying for treehopper species in a wooded area by handpicking, sweeping and sticky-cylinder trapping, few additional species may be gained by placing sticky-cylinder traps 6 m or higher above the ground. However, some tree dwelling species can be more abundantly collected at the higher levels, which gives an indication of population stratification in a deciduous forest.

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#### LITERATURE CITED

- Adlerz, W.C. 1976. Comparison of aphids trapped on vertical sticky board and cylindrical aphid traps and correlation with watermelon mosaic virus 2 incidence. *J. Econ. Entomol.* 69:495-498.
- Bray, D.F. and C.A. Triplehorn. 1953. Survey of the insect fauna of red and pin oaks in Delaware. *Univ. Delaware Agr. Exp. Sta. Bull.* 297. 28p.
- Dennis, C.J., and R.J. Dicke. 1953. The Membracidae of the University of Wisconsin Arboretum. *Trans. Wisconsin Acad. Sci. Arts and Letters* 42:131-141.
- Kopp, D.D., and T.R. Yonke. 1970. Annotated List of treehopper species (Homoptera: Membracidae) of Missouri and evaluation of collection methods. *Trans. Missouri Acad. Sci.* 4:76-83.
- Mason, C.E. and J.E. Loye. 1981. An Annotated List of Treehoppers (Homoptera: Membracidae) of Delaware. *Entomol. News.* 92:1:33-37.



Species	Hand-Picking/ Sweeping	Sticky-cylinder traps									
		1m	3m	6m	9m	12m	15m	18m	21m	24m	27m
<i>Telamona ampelopsidis</i> (Harris)	2	2		1							
<i>T. collina</i> (Walker)	1										
<i>T. decorata</i> Ball	3	4	1	21	24	17	23	1	2	7	2
<i>T. extrema</i> Ball	3							1	1		
<i>T. monticola</i> (F.)	19	3		29	8	5	13	5	1	1	1
<i>T. tiliae</i> Ball	5										
<i>T. unicolor</i> Fitch	3	2			3	1	7	1		1	
<i>T. westcotti</i> Goding							1				1
<i>Phelia bimaculata</i> (F.)	2										
<i>Vanduzeeea arquata</i> (Say)	28										
<i>Xantholobus intermedius</i> (Emmons)	1										
<i>X. lateralis</i> VanDuzee	1	2	4	1							
<i>X. muticus</i> (F.)	14	1	8	15	1						

Table 2. Most abundantly captured treehopper species on sticky-cylinder traps for the duration of the study in the University of Delaware Woodlot during 1978-79.

Species	Total of all Traps	Mean number of treehoppers per trap									
		1m	3m	6m	9m	12m	15m	18m	21m	24m	27m
<i>Entylia carinata</i>	194	21.1	0.2	0.6							
<i>Acutalis tartarea</i>	132	14.7									
<i>Telamona decorata</i>	102	0.4	0.2	4.2	4.8	8.5	11.5	0.5	1.0	3.5	1.0
<i>Micrualis calva</i>	89	9.9									
<i>Cyrtolobus tuberosus</i>	71	1.2	6.4	3.8	1.6		0.5				
<i>Telamona monticola</i>	66	0.3		5.8	1.6	2.5	6.5	2.5	0.5	0.5	0.5
<i>Cyrtolobus dixianus</i>	56	1.3	2.6	4.0	0.6	3.0	1.0				